

**SUMMARY OF RESULTS FROM THE  
CALIFORNIA PESTICIDE ILLNESS  
SURVEILLANCE PROGRAM  
- 1999 -**

**HS-1811**

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## **Pesticide Illness Surveillance Program – 1999**

### **Background on the Reporting System**

The California pesticide safety program, which the California Environmental Protection Agency (Cal/EPA), Department of Pesticide Regulation (DPR) administers, is widely regarded as the most stringent in the nation. It includes requirements for thorough data review of all pesticides<sup>1</sup> before registration for use in California, safety training of all pesticide handlers and field workers, and ongoing monitoring of people and the environment to detect potential for pesticide exposure. Mandatory reporting of pesticide illnesses has been part of this comprehensive program since 1971. The U.S. General Accounting Office (GAO, 1993) noted that "California had by far the most effective and well-established monitoring system in place" and that the U.S. Environmental Protection Agency (U.S. EPA) "relies heavily on the pesticide illness data collected by the California monitoring system ... and has tried to encourage selected states to develop monitoring systems modeled after the California system." Several other states have initiated surveillance programs for pesticide illness. As yet, most of them have collected only limited numbers of case reports, and the U.S. EPA still relies heavily on California data.

DPR maintains its surveillance of human health effects of pesticide exposure in order to evaluate the circumstances of pesticide exposures that result in illness. Under a statute enacted in 1971 and amended in 1977 (now codified as Health and Safety Code Section 105200), California physicians are required to report any suspected case of pesticide-related illness or injury by telephone to the local health officer within 24 hours of examining the patient. The health officer informs the county agricultural commissioner (CAC) and also completes a pesticide illness report (PIR), copies of which are distributed to the Cal/EPA Office of Environmental Health Hazard Assessment, to the Department of Industrial Relations (DIR), and to DPR. Staff members regularly consult the data collected to evaluate the effectiveness of DPR's pesticide safety regulatory programs and assess the need for changes.

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<sup>1</sup> "Pesticide" is used to describe many substances that control pests. Pests may be insects, fungi, weeds, rodents, nematodes, algae, viruses or bacteria -- almost any living organisms that cause damage or economic loss, or transmit or produce disease. Therefore, pesticides include herbicides, fungicides, insecticides, rodenticides, disinfectants, as well as insect growth regulators. In California, adjuvants are also subject to the regulations that control pesticides. Adjuvants are substances added to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, and wetting and dispersing agents.

DPR strives to ensure that the PISP captures the majority of illness incidents. For example, since doctors do not always properly report pesticide cases, DPR's Worker Health and Safety Branch (WH&S) also reviews Doctors' First Reports of Occupational Illness and Injury (DFROII), which California's Labor Code requires workers' compensation claims payers to forward to DIR. Staff members select for investigation any DFROII that mentions a pesticide, or pesticides in general, as a possible cause of injury. Reports that mention unspecified chemicals also are investigated if the setting is one in which pesticide use is likely. In typical years, DFROII review identifies two-thirds to three-quarters of the incidents investigated.

During 1999, U.S. EPA provided funds to DPR to contract with the California Poison Control System (CPCS) to facilitate illness reporting. Under the contract, poison control staff workers reminded health care personnel of the reporting requirement and offered to handle the paperwork. They faxed copies of the report form to facilities that chose to report independently. Poison control efforts contributed to the transmission of 17 percent of the cases investigated during 1999. The majority of the poison control-mediated reports were the only notification of those incidents. A summary of the reporting results from CPCS can be found at the end of this document.

The agricultural commissioner of the county where the incident occurred investigates each incident. DPR provides instructions, training, and technical support for conducting investigations. These instructions include directions for when and how to collect samples of foliage, clothing, or surface residues to document environmental exposures. As part of the technical support, DPR maintains specialized laboratories to analyze the samples. The CACs prepare reports describing the circumstances in which pesticide exposure may have occurred and any other relevant aspects of the case. When appropriate, they request authorization from the affected people to include relevant portions of their medical records with the report. When investigations identify additional affected people (not previously reported by other mechanisms), they are identified in the investigation report and recorded in the PISP database.

WH&S scientists evaluate the physicians' reports and all the information the CACs have gathered, and classify incidents according to the circumstances of exposure to a pesticide. Evaluators undertake a complex task of determining the likelihood that a pesticide exposure caused the incident.

Excessive exposure to pesticides may cause illness by various mechanisms, and the surveillance program attempts to monitor all of them. Every pesticide active ingredient has a pharmacologic effect by which it controls its target pests. Pesticide products may have other potentially harmful properties in addition to the qualities designed to control pests. The Pesticide Illness Surveillance Program (PISP) collects information on adverse effects from any component of pesticide products including the active ingredients, inert ingredients, impurities, and breakdown products. Whether pesticide products act as irritants or as allergens, through their smell or by causing fires or explosions, DPR's mission is to mitigate exposures that compromise health.

The PISP database provides the means to identify high-risk situations warranting DPR action including the implementation of additional California restrictions on pesticide use. Taking illness data into consideration, DPR may adjust the restricted entry interval following pesticide application, specify buffer zones or other application conditions, or require pesticide handlers to use protective equipment that meets certain standards. In some instances, changes to pesticide labels provide the most appropriate mitigation measures, and DPR cooperates with the U.S. EPA to develop appropriate instructions for users throughout the country. Use of liquid nitrogen for termite control gave rise to one such cooperative effort. Following the death by asphyxiation of a California liquid nitrogen applicator in 1989, California and federal staff worked together to develop additional safety measures, which are now in force nationwide. If an illness incident results from illegal practices, state and county enforcement staff take appropriate action to deter future incidents.

DPR scientists participate in the working group convened by the National Institute for Occupational Safety and Health (NIOSH) to develop standards for collection of information on

pesticide illnesses. NIOSH now partially supports programs in the states of Florida, New York, Oregon, and Texas, which make use of the standards that the working group defined. This NIOSH program also supports pesticide work by the Occupational Health Branch of the California Department of Health Services, which coordinates closely with the DPR program.

### **Changes to the Data Collection Program**

The PISP continues to collect data using the revised and enhanced computer program that debuted in 1998. The new program provided the opportunity to increase the amount of data collected and to organize it more logically. Analysis is in progress to develop a system to make surveillance data available to the public via the DPR Internet web site.

The new system's most obvious change concerns the categories into which the program classifies the activities of the affected people. Under the former system, activity codes combined aspects of occupation, mechanism of exposure, and equipment used. The new, expanded system provides three separate entries for activity, exposure, and equipment used. We can identify the activities of people who were drifted upon and distinguish among sprays, spills, and drift exposures to applicators.

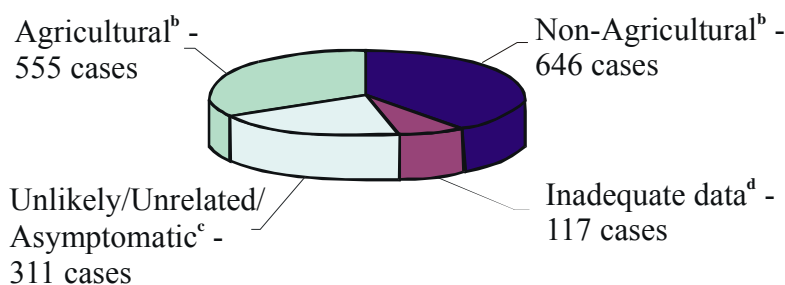
The new system also allows us to record registration numbers, types of formulation, and application dates and sites individually for an unlimited number of different pesticides in each case. This allows us to respond more fully and accurately to inquiries about particular products and uses.

### **1999 Numeric Results -- Totals**

During 1999, DPR received reports of 1,629 people whose health may have been affected by pesticide exposure. After investigation, WH&S analysts found that pesticide exposure had been at least a possible contributing factor to 1,201 (74 percent) of the 1,629 cases. Of those 1,201 cases, 555 (46 percent) involved use of pesticides for agricultural purposes and 646 (54 percent) occurred in other settings. Evidence established a definite relationship to pesticide exposure for 195 of the cases. Another 635 were classified as probable, with 371 entered as possible. Of the

1,629 cases investigated, 428 either had insufficient data available to evaluate the case (117 cases) or evidence established an unlikely or unrelated relationship to pesticide exposure (311 cases). Tabular summaries presenting different aspects of the data are available through DPR's Web site at <[www.cdpr.ca.gov](http://www.cdpr.ca.gov)>, or by contacting the WH&S Branch.

**Figure 1: Outcome of 1999 Pesticide Illness Investigations<sup>a</sup>**



<sup>a</sup> Total cases investigated = 1,629

<sup>b</sup> Agricultural and Non-Agricultural refers to the intended use of the pesticide (or the exposure setting where no pesticide use was involved).

<sup>c</sup> Unlikely/Unrelated/Asymptomatic refers to cases determined as unlikely related or unrelated to pesticide exposure or the exposed person did not develop symptoms.

<sup>d</sup> Inadequate Data means that there was not enough data available or reported to determine if pesticides were involved in the case.

The 1,629 total cases investigated in 1999 represent an increase of 148 (10 percent) relative to 1998, when 1,481 cases were investigated because of some indication that they might reflect adverse effects of pesticides. There was an increase of 203 (20 percent) pesticide-related cases in 1999 (1,201 cases) relative to 1998 (998 cases). The increase reflects the impact of several major episodes, especially one in which breakdown products of the pesticide metam-sodium drifted into the town of Earlimart, prompting an evacuation. At least 170 individuals developed health complaints linked to this incident. Another 62 people were affected by an application of diazinon to shrubbery at a school, and 54 were affected by gas generated when incompatible chemicals (citric acid and sodium hypochlorite) were combined inadvertently in the course of a delivery to a packing house. The largest group episode of 1998, by comparison, involved 34 field workers

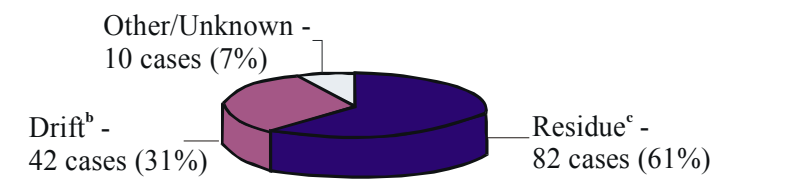
who unknowingly entered a sprayed cotton field prior to the expiration of the restricted entry interval.

Occupational exposures (those that occurred while the affected people were at work and eligible for workers' compensation) accounted for 804 (67 percent) of the 1,201 pesticide-related cases identified during 1999. Actions already prohibited by pesticide safety regulations contributed to 594 (49 percent) of the 1,201 cases evaluated as definitely, probably, or possibly related to pesticide exposure. Investigations did not clearly establish whether or not violations contributed to pesticide exposure in 78 other cases, and violations were identified in 111 more cases in which they did not contribute directly to the problem. This indicates that safety could be further improved through increased compliance efforts. In 1999, DPR established the Enforcement Initiative, a program to thoroughly evaluate and improve all aspects of enforcement of pesticide safety laws and regulations. In addition, WH&S staff initiated meetings with worker safety advocacy groups, agricultural industry groups, and the County Agricultural Commissioners to assist in evaluating the effectiveness of existing regulations and to determine what is needed to improve farm worker safety.

### **Agricultural Field Worker Incidents**

In 1999, 134 cases involving field worker illness and injury were reported. Exposure to residue was implicated for 82 field workers. Another 42 field workers were exposed to drift, and 10 encountered other or unknown exposures. Due to changes in the database, the number of field workers exposed to residue may not be exactly comparable to the numbers of individuals reported exposed to field residue prior to 1998. Before 1998, the category 'exposed to field residue' included all people who had any sort of contact with pesticide residue on crops, including smelling it while passing by.

**Figure 2: Field Worker Exposure,  
1999<sup>a</sup>**



<sup>a</sup> Total field workers cases for 1999 = 134

<sup>b</sup> Drift refers to field workers exposed to drift while working in agricultural fields.

<sup>c</sup> Residue refers to field workers exposed to pesticide residue on crops.

Of the total 134 cases of field workers exposed to pesticides by any mechanism, DPR classified 93 as possible and 41 as probable. Exposures to residue gave rise to 59 of the cases classified as possible and 23 of those classified as probable. Illegal reentry during the restricted entry interval contributed to only eleven (13 percent) of the 82 cases of field workers exposed to residue. Other violations contributed to 28 (34 percent) of the 82, including eight that also involved reentry violations.

WH&S scientists assisted the CAC investigators and became involved in two major investigations of field worker reentry episodes. In one incident, grape harvesters experienced sneezing, flu-like symptoms, and burning and itching on their arms, neck, face, and eyes about three hours after entering a vineyard where they had not worked before. Seven workers sought and received medical treatment. WH&S sent scientists to collect and transport foliage samples to the laboratory for dislodgeable residue analysis.

Pesticide use reports indicated that dusting sulfur and propargite had been applied to the grapevines. Analysis of the initial foliage samples revealed that  $\lambda$ -cyhalothrin, which is not registered for use on grapes, had been applied at a rate far above rates recommended for any crop. The Fresno County Agricultural Commissioner declared the episode field to be a hazardous area due to high levels of propargite residues and illegal  $\lambda$ -cyhalothrin residues. In addition, WH&S scientists conducted a focused foliage sampling effort to determine if cyhalothrin was in use in other vineyards and to determine the amount of propargite in other vineyards.



Investigation ultimately determined that the pesticide had been delivered in error, and that workers making a scheduled application had included the unexpected product without consulting their supervisors. Samples from other local vineyards demonstrated that the application had not contaminated neighboring fields and cyhalothrin was not used in other vineyards. In addition, the incident vineyard had propargite levels comparable to other vineyards treated similarly. While propargite residue may have contributed to the incident, the high levels of  $\lambda$ -cyhalothrin were considered the primary cause of the outbreak.

WH&S had no scientific data from which to estimate the decay rate for such high residues of  $\lambda$ -cyhalothrin. Consequently, on October 26, 1999, WH&S issued a guidance to Fresno County, specific to the incident vineyard stating that 1) employees must not perform any activities involving foliar contact and 2) all persons must wear specified personal protective equipment for field entry that did not involve foliar contact. The licensed pesticide dealer was fined \$1,000 for selling or delivering a pesticide for a use not shown on the label. In addition, the applicator was fined \$1,000 for using a pesticide in conflict with the label.

In a second incident, a crew entered a Kern County cotton field about five hours after it was treated with a mixture of tribufos and sodium chlorate. Entry to this field should have been restricted for 24 hours following the application. Workers were removed from the field after three hours of work. All eight workers were evaluated medically, although only one worker experienced symptoms at the time. The next day, WH&S scientists collected foliage samples and transported some of the workers' contaminated clothing to the laboratory in Sacramento for analysis, which confirmed presence of tribufos.

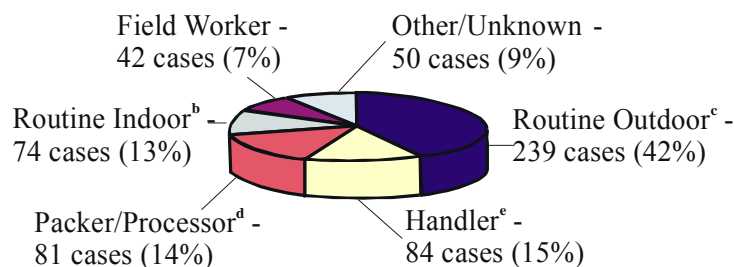
During the next three weeks, seven of the eight workers sought treatment for symptoms including nausea, vomiting, abdominal cramping, diarrhea, constipation, muscle soreness and weakness, headache, intermittent dizziness, shortness of breath, fatigue, chest pain, cough, sore throat, ear pain, congestion, dermal burning, rash and skin lesions, hair loss, and night sweats. All seven persons reported symptoms at their 1-week post-exposure check-ups. Five of the seven reported persistent symptoms at follow-up evaluations 2 weeks post-exposure. Two of

these five women were admitted to hospital approximately three weeks post-exposure. WH&S's Medical Consultant provided telephone consultation to the primary care physician regarding the two women admitted to hospital. Some of the workers continue to have health problems. WH&S is developing a separate report on this incident. The county identified several violations, including early reentry, failure to provide accurate notification regarding the application and failure to post the field. Administrative civil penalties of more than \$5,000 were issued to the applicator and the cotton grower.

### **Drift Exposure**

As in 1998, drift exposures accounted for the largest number of pesticide exposures in 1999. A total of 570 individuals reported symptoms definitely, probably or possibly related to exposure to drift. This includes the 170 people identified as affected by the episode at Earlimart, in addition to 42 field workers, 81 people packing or processing harvested crops, 15 mixer/loaders and 64 applicators. Drift from agricultural applications was responsible for 361 of the 570 drift exposures, including all 42 field workers and 65 of the 81 packers, but only 15 of the applicators and none of the mixer/loaders.

**Figure 3: Drift Exposures by Activity, 1999<sup>a</sup>**



<sup>a</sup> Total drift cases for 1999 = 570

<sup>b</sup> Routine Indoor includes people in offices and businesses, residential structures, etc. (occupational and non-occupational) who are not handling pesticides.

<sup>c</sup> Routine Outdoor includes people outdoors (occupational and non-occupational) with little expectation of contacting pesticides (e.g. gardeners not handling pesticides, residents).

<sup>d</sup> Packer/Processor includes persons involved in processing harvested crops.

<sup>e</sup> Handler includes people mixing, loading and applying pesticides; repairing pesticide equipment; and flagging for aerial applications.

As mentioned previously, three significant drift episodes accounted for 286 of the 570 people with symptoms definitely, probably, or possibly caused by drift exposure. The largest occurred in November 1999, when the Wilbur-Ellis Company fumigated a 75-acre field near the town of Earlimart with metam-sodium. Fumes drifted into an adjacent residential area, forcing about 180 residents to evacuate their homes. About 46 sought medical attention, and about 28 have reported ongoing medical problems. DPR recorded 170 symptomatic individuals as definitely, probably, or possibly affected by exposure in this episode. An investigation by DPR and the Tulare County Agricultural Commissioner's Office concluded that Wilbur-Ellis failed to use appropriate safeguards to prevent the fumes from drifting.

DPR reached a settlement with Wilbur-Ellis, under which the company agreed to pay DPR \$75,000 in civil penalties. The settlement provides another \$75,000 for continued medical monitoring for Earlimart residents. In addition to the settlement's financial terms, Wilbur-Ellis agreed to take corrective action on the firm's future use of metam-sodium in California. Among other conditions sought by DPR, Wilbur-Ellis agreed to provide drift reduction training for supervisors and applicators in California, and develop an emergency response notification plan by November 1, 2000. The settlement also requires all California employees of Wilbur-Ellis to

receive appropriate training before they handle or apply metam-sodium products. DPR will monitor worker training.

The second significant drift episode occurred when a delivery driver's error caused evacuation of about 100 people from a San Diego County packing plant. He began pumping citric acid into the facility's sodium hypochlorite storage tank. Ordinarily, sanitation equipment combines the two chemicals in small and carefully controlled amounts. More than fifty people developed symptoms attributed to exposure to the chlorine gas generated by this unintentional combination.

Another major episode took place at a San Diego County school. A maintenance worker sprayed shrubbery with diazinon during school hours, and the ventilation system distributed the odor within the school building. The school nurse contacted several students with known respiratory problems and sent them home before they developed symptoms. The administration allowed students to leave if they felt the exposure affected them, and several dozen students and one teacher reported symptoms.

WH&S became involved in the investigation of another drift episode, requesting the collection of urine samples from a construction crew that reported drift from a nearby aerial application, and retrieving those samples and some articles of clothing for analysis. Laboratory results substantiated the workers' complaints, identifying naled as well as chlorpyrifos in their clothing, and chlorpyrifos metabolites in their urine. A fine of \$3,000 was levied against the applicator.

### **Morbidity and Mortality**

Among the 830 cases evaluated after investigation as definitely or probably related to pesticide exposure, 32 people were hospitalized and 126 lost time from work. Of the 371 possible cases, two reported hospitalization and 51 lost work time.

In 1999, there were eight fatalities investigated; four proved related to pesticide exposure, contradictory information prevented classification of two fatalities and two fatalities were proved unrelated to pesticide exposure. The pesticide-related fatalities included two ingestions, an

explosion, and the death of a person who had crawled under tarps of a structure under fumigation.

Of the two ingestion fatalities, one ingestion was still under investigation by police at the close of the pesticide investigation. Although it is certain that death resulted from pesticide ingestion, no conclusion can be made as to whether the decedent intended to commit suicide, committed a fatal error, or was the victim of foul play. The other ingestion was considered a suicide.

In Los Angeles County, a worker was killed in an explosion and fire at a facility that ripened bananas using ethylene gas. (Ethylene gas is regulated as a pesticide.) The fire department and the state Occupational Safety and Health Administration continued to investigate this episode after termination of the pesticide investigation.

A person was found dead in an alley one morning. A homeless man who frequented the area reported that he had spoken with the decedent the previous night, and that the victim had said he felt sick because he had been in a house under fumigation. On this basis, a post-mortem blood sample was analyzed for fluoride. A positive result confirmed sulfuryl fluoride intoxication as the cause of death.

Due to contradictory information, the death of another person could not be evaluated, although his body was found in a fumigated structure. Tests were reported as documenting an elevated fluoride level in the victim, but the pest control operator maintained that he had fumigated the structure with methyl bromide. No information could be obtained to resolve the contradiction.

No conclusion could be reached, either, regarding pesticide involvement in the death of an agricultural worker whose body was found near an opened water-soluble package of methomyl. Some testimony indicated that the man may have opened the methomyl to make bait (methomyl sprinkled on hot dogs) for coyotes (an illegal use of the product in several respects) and suspicion was high that he had absorbed the pesticide through his skin. Toxicologic testing, however, identified benzothiazole as the toxicant. Although benzothiazole-related compounds

are used in some pesticide products for sanitation, preservation of wood, and to control fungi during industrial processes, no source could be determined in this case. The substance also has non-pesticidal uses, such as antifreeze and has been found in asphalt fumes and reservoir sediments.

Two deaths were found unrelated to pesticide exposure. An aerial applicator died in surgery two days after crashing a helicopter. He was alert following the accident, and reported mechanical malfunction in his aircraft. The other fatality involved a ground applicator who fell beneath the wheels of his tractor and was crushed.

### **Examples of the Importance of Compliance with Safety Procedures**

Severe intoxications typically result from careless and often illegal use of pesticides. In two separate episodes, two children were hospitalized during 1999 after exposing themselves to insecticides that they found in soft drink containers at their homes. In one instance a young boy found the soda container on a workbench and drank from it before realizing it did not contain the expected beverage. In the other case, a parent mixed malathion and chlorpyrifos in a soda can, intending to drop the can into a sprayer and fill it with water. He was distracted long enough to allow a toddler to grab the can and spill the contents on his skin and lips. Both children were successfully treated at local hospitals. Regulations prohibit storing pesticides in any container that does not identify the contents appropriately. Using a food container for the purpose compounds the danger.

Two other children were exposed to pesticides they found in unattended spray containers. One child found a nearly empty sprayer and played with it, spilling the contents all over her skin. The parent assumed the container was empty, but did not wash the container after completing the application. The child had massive dermal exposure and was hospitalized. Another child was able to knock a spray bottle from the top of the refrigerator by slamming the door. She proceeded to spray the contents into her mouth, as the spray bottle was similar to one the family used for water. Both children were successfully treated at local hospitals.

### **Results of Cooperation with Poison Control**

As discussed previously, DPR constantly attempts to improve reporting of pesticide illnesses. In 1999, DPR contracted with the U.S.EPA to evaluate the potential of using poison control contacts with physicians to assist them in reporting pesticide cases. Under terms of the contract, poison control technicians reminded health care workers that State law requires doctors to report any disease or condition that they suspect of deriving from pesticide exposure. The poison control staff also offered to record the information required and to fulfill the reporting requirement on the doctor's behalf.

DPR logged 284 poison control-mediated cases during 1999. After investigation, 232 of these were evaluated as definitely, probably, or possibly related to pesticide exposure. Of the 397 cases reported by all methods (PIR, DFROII, poison control) that were associated with non-occupational exposures, poison control mediated 26% (102 cases) of the reports. In particular, poison control reported 22 of the 57 total cases involving children younger than ten years old and 15 of the 34 in which people were admitted to hospitals for at least 24 hours. Poison control reported all ten of the case reports received regarding ingestion of pesticides by children, and all but two of the 18 reported cases of intentional pesticide ingestion. Ingestions by young children were not recorded as intentional.

Those figures demonstrate the importance of poison control intervention to identify non-occupational and pediatric pesticide exposures. This cooperation has been valuable to DPR surveillance, which otherwise has limited ability to detect health problems caused by home-use pesticides.

Poison control intervention also helps to expedite reporting. DPR received 261 notifications within one week of the occurrence; poison control mediated 186 those reports, including 12 of 14 that arrived on the day of the event and 35 of 40 cases that arrived the day after exposure occurred. The average time from exposure to report was just 22 days for reports mediated by poison control, compared to 77½ days for all other reports. Prompt notification enhances the

value of investigation, as county agricultural commissioners take advantage of the opportunity to collect environmental samples and to interview the people involved.

### **References**

GAO 1993. Pesticides on Farms: Limited capability exists to monitor occupational illnesses and injuries. Report to the Chairman, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate GAO/PEMD-94-6.